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ABSTRACT

The effort to strengthen the critical thinking skills of students in the last two decades has led to an abundance of instructional programs instituted across disciplines and integrated into core curricular requirements at United States colleges and universities. There is no theoretical consensus about what critical thinking is; neither is there a consensus about what standards or rules are needed to guide the differences between "good" and "bad" reasoning. Whether or not theorists and researchers address the issue, critical thinking is a function of intellectual performance. Differences across groups or populations are either largely inherited, learned, or some combination of both, the precise breakdown of which is still not fully understood. The theoretical notion that the brain and the exercise of its potential is somehow immutable is a myth. Those who argue that environmental and social influence are the only controlling elements of the explanation of intellectual performance are equally narrow in their analysis. The research in critical thinking, though well-intentioned and important, is in its infancy. If valid and effective programs are to be developed at all levels of education, then a more effective interdisciplinary approach appears a necessity, one that includes biologists and neurologists. (Contains 34 notes.) (RS)

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Critical Thinking Theory and Research:
A Movement in Search of Itself

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ABSTRACT: The effort to strengthen the critical thinking skills of students in the last two decades has led to an abundance of instructional programs instituted across disciplines and integrated into core curricular requirements at U.S. colleges and universities. The exigence to do so, to implement something, has created all the characteristics of a social movement. However, there is still considerable debate about what constitutes critical thinking, its measurement and the presumed effectiveness of various programs specifically designed to enhance student performance. Within that context, this paper explores the less than satisfactory constructs and definitions of critical thinking, the problems dealing with the issue of individual variance, and lastly, the social and political implications of those factors associated with performance which have not been fully understood nor researched by central figures in the movement.

Critical Thinking Theory and Research:
A Movement in Search of Itself

> The need of reason is not inspired by the quest for truth but the quest for meaning. And truth and meaning are not the same.
>
> Hannah Arendt, The Life of the Mind[1]

In recent years little has stoked the fires of controversy in education and educational politics as much as questions surrounding the nature of critical thinking. The concern of educators--and perhaps more importantly those political constituencies to which educators and administrators are ultimately responsible--has been driven by the apparent inability of students to critically examine their own ideas as well as the ideas of others.[2] If accurate, the implications are profound. In a nation which characterizes itself as democratic--however loosely defined--one of the central rationales for public education involves the preparation of the young for their roles as citizens. The exercise of such a role absent of the capacity to evaluate ideas could have serious consequences which could lead to far greater levels of intolerance than currently exist and, tragically, to the eventual erosion of the collective responsibility to govern ourselves. If diversity should be celebrated and engaged rather than eliminated--directly or subtly

socialized out of existence--then the need for the critical component in our search for meaning, the need to understand and interpret the complex forces of social and political change, has become indispensable to our personal and collective survival.

Though I share the interest of many educators with the investigation, measurement and practice of critical abilities, it is not for the rather narrow purposes of its role in the educational system as it is currently and commonly applied. Though perhaps important to some, vocational training or making adjustments to the geo-political conditions of a market economy seem less important than the purpose of developing in students what Harvey Siegel calls the "critical spirit."[3] Though the more venal appraoches to training may provide systems--standards and rules--of ordering and regulating the understanding of physical and metaphysical phenomena, what I am suggesting is that the search for meaning, though always problematical, is far more fundamental and a principle around which the best of Western institutions were organized. Such a search is inherently subjective, valuative and relative to the framework of variety of people, cultures and fields of inquiry. To construct meaning is to make connections via general principles mediated by the standards, if they exist at all, of a particular context.[4] A search for meaning is at its most primary level the attempt to make whatever limited sense of the experience and coherence of knowing and living that we can. To do so is minimally an attempt to empower people with a degree of personal and political control

over their lives.

The purpose of this paper then is to examine three relevant issues: First, the less than satisfactory theoretical constructs and definitions of critical thinking; secondly, in the area of assessment, the problem of accounting for those factors associated with the variance in test scores across groups and populations, and lastly, the social and political implications of employing instructional programs when those factors have not been completed understood or adequately investigated.

I

Concepts of Critical Thinking and Their Measurement

Though there are many important theorists of intelligence and critical thinking, one of the most notable investigators is Robert H. Ennis, whose 1962 paper in the Harvard Educational Review is thought to have laid the foundation for the critical thinking movement.[5] As apart of the tradition of formal and informal logic in philosophy, Ennis identified an inventory of critical thinking which he argued was both teachable and transferable. Though I believe that this is possible, it first depends upon how one defines the skills, which in his analysis must be field independent, and, secondly, involves an understanding not reflective in the writings of the theorists of critical thinking of how the methods/procedures of validating claims with several categories of issues are different in the variety of fields of critical investigation. The clear

identification of critical thinking principles is essential because without it an instructional program designed to instill the skills in students would make little sense; the largest part of the movement's fragmentation is due largely its lack of a consistent theoretical base.[6] To Ennis' credit, he did not isolate the skills in a pure form but suggested that their execution was dependent on the nature of a person's interaction with the environment as well as the clarity and depth of the content knowledge that is the basis of judgment. After some degree of reflection, Ennis later refined his position to include a person's tendency or disposition to critically think as a essential factor in doing it well.[7] In other words, there must be a recognition by the person that the activity is of value. If so, he believes that the skills are generalizable and transferable to other fields and activities. Ennis' foundational efforts generated a good degree of scholarly interest, yet raised fundamental issues which still afflict the movement. First of all, no one disagrees that critical abilities in education, or medicine and the law for that matter, are important; to deny their significance is comparable to denying the most deeply held of assumptions and practical realities facing any profession or culture.

Yet, there is no theoretical consensus about what critical thinking is;[8] neither is there a consensus about what standards or rules are to guide the differences between "good" or "bad" reasoning. In addition, neither is there general agreement on

the method(s) by which such judgments are to be made. The sciences, social sciences and humanities all have different methods but the superiority of some rather than others is sometimes relative.[9] For example, legal issues of fact are resolved in terms of criteria established by rules of evidence.[10] In mathematics or the social sciences, different criteria of what constitutes good reasons are at play. What is important to note is that though the methods and/or procedures of validating claims may be different across fields, are the forms of reasoning thereby distinct? Hardly. People will still have to reason inductively or deductively to explain or justify a claim; each field, though varied and at times not always distinct, has for its own purposes developed relatively stable procedures with which one must be familiar to critically evaluate the claim. However, it involves the acquisition of sufficient background knowledge of the field and how the procedures have produced a body of thought to guide "good" reasons for a position or behavior.[11]

As Siegel believes, becoming familiar with or guided by these context-relative criteria is not to sanction them as the sole arbiters of judgment, nor does it prevent one from dealing with novel problems within those contexts.[12] Though Siegel would probably agree with Arendt's statement quoted above that reason has to do with something other than "truth"--in his case rational justification--he also feels we must reject relativism in that rationality is an absolute and does not vary across

persons, times or cultures. While perhaps the case with issues of fact, it rarely is an absolute when assessing issues of value, which most frequently has less to do with didactic knowledge--the synthetic principles of abstract reasoning--than the ability to survive and adapt by those personal rules generalized from the experience of living.

Critical thinking is difficult to define. So then how can we develop programs which are supposed to encourage its development in students apart from the context of a discipline? Many scholars, not unlike Ennis, avoid the difficulty by creating inventories believed to constitute the skill of critical thinking. Ennis' inventory includes twelve items that have to do with such things as the ability to identify and define problems, recognize ambiguity and contradictions, reliability, warranted conclusions or assumptions.[13] Unlike some investigators who agree that critical thinking is finally a skill, Ennis took a further step and along with Jason Millman, developed the Cornell Critical Thinking Tests in the effort to assess programs as well as a student's level of proficiency.[14] Along with Goodwin Watson and Edward Glaser's Critical Thinking Appraisal, who argue that the skill is composed of an assessment of "problems, statements, arguments, and interpretations of data similar to those that are encountered on a daily basis at work, in the classroom, and in magazine articles," the tests are the most widely used forms of standardized measurement by educational institutions.[15] If one accepts the relative validity of such

inventories,[16] they can tell us at what level students can perform them. What they cannot reveal is the far more important question of why or the meaning of the variability in measurment scores; without a degree of consensus about what constitutes critical thinking, either theoretically, in terms of skills or their measurement, such primary questions will continue to go unanswered.

The essential thrust of Ennis, Watson, Glaser as well as others in their commendable effort to conceptualize and measure critical thinking is that they characterize or evaluate outcomes logically. The early work of Jerome Bruner, Jacqueline Goodnow and George Austin reversed the perspective and suggested an incredibly important and new approach to our understanding of thinking. Their work was the first to take critical thinking as possibly better explained psychologically rather than evaluated logically. As Bruner argued, "logic is not a process... but rather it is a characterization of the results of a process at work."[17]

This provocative insight--the focus on that which allows for the rational to occur--has yet to be fully developed by those theorists and researchers interested in critical thought. For example, in his evaluation of Ennis' work, Harvey Siegel provides us with a fairly exacting explanation of "the critical spirit" and how measures of critical thinking do not account for it.[18] For Siegel, a true critical thinker must have a certain character, a character which seeks reason and avoids arbitrary

judgment. Skills and abilities are of only partial necessity; there must also be a love or passion for ideas even when what is discovered is in contradiction to one's most deeply held convictions. The character of such a person is not immutable, a machine devoid of emotion; rather, emotional sensibilities are often the fuel for being a rational and humble actor in human affairs. Siegel sees these qualities as reflective of traits of the person which exist independently of the proficient exercise of skills and abilities. A critical spirit is a person who is "emotionally secure, self-confident, and capable of distinguishing between having faulty beliefs and having a faulty character."[19]

If Bruner--and by extension Siegel--is correct, then can these trait(s) of the person be explained experimentally? Sternberg claims that we have just begun to scratch the surface--at least empirically--and that the obvious lack of knowledge has a significant impact on the mistakes we may be making pedagogically; we simply may not know enough about the cognitive process which allows for rational judgment. Without it, the design of effective programs is left wanting.[20]

II

Mental Performance and the Still Troubling Issue of Heredity

Whether or not theorists and researchers address the issue, critical thinking is a function of intellectual performance. Differences across groups or populations are either largely inherited, learned or some combination of both, the precise

breakdown of which is still not fully understood. Why does the question persist? In spite of the claim of Arthur Jensen that the social or political implication of a study is a scientific non sequitur, the question persists because without some answer the support or funding of innovative programs becomes meaningless. We still have been unable to consistently establish why some students do improve and some do not; if we do not know what an instructional program will achieve, why fund it? Or, are we merely improving the skills of the game for those few from the "right" gene pool or social class?[21]

The literature on the question of innate abilities versus environmental influences is considerable and the purpose of this exposition is not review it in any great detail; however, the issue of individual differences on the performance of critical skills is indispensable to solid theory and research. One of the indictments of critical thinking measures is that they are comparable to I.Q. tests and, as a result, not only of little value but reductionist, as well. Perhaps. But, irrespective of the measure employed, the question of the meaning of variance will not disappear. Some students do outperform others and some do improve more than others. How do we interpret such data? What factors are considered important to high and low achievers? Which go unexplained or unexamined? Such questions drive us inexorably back to the question of heredity versus environmental influences.

Probably the most significant contemporary contributor to

the genetic school of thought, tracing individual differences to heredity (the mysterious "g" factor), is Hans Eysenck. Eysenck wants to restore a more biological scheme to our conception of human nature[22] He has serious concerns about American researchers' disregard for the issue of individual differences, particularly with the categories of intelligence, race or sex; he claims the disregard is more a function of politics than scientific oversight. Coupled with the retreat from the biological causes of behavior, he further argues that personality theorists have abandoned scientific methods and principles, giving up entirely the standards of reliability and validity with "the appearance of so-called mental tests."[23]

Eysenck argues that modern biology has passed by the entire discipline of psychology. He does not exclude social or cultural factors to explain mental capacity; he merely emphasizes biological ones more heavily, to the extent that biology accounts for 80% of mental functioning.[24] He also contends that "highly" reliable and valid questionnaire data can accurately measure personality traits as well as intelligence; however, it is questionable whether such methods can support fundamental laws and relationships similar to those in biology or physics. Eysenck insists that we should begin viewing people as the outcome of hundreds of millions of years of an evolutionary process, that the development of the best of the species is mirrored in the brain where "intelligence and ability generally are properly and more closely related to differential structures

in functioning of the neocortex."[25] Instead of emphasizing cognitive factors, as is the trend in American psychology, he believes we should be analyzing the manner in which biological factors determine cognitive styles, including mental performance. Most importantly--and Eysenck is not alone in its emphasis--there are no mental events without the neural events underlying them.

In a way, the use of "science" as an adjective to the noun research makes it a god-term. In this century, "scientific research" is afforded an incredible level of merited and/or unwarranted credibility, not unlike the often highly polarized distinction between research in the social sciences and the humanities where the methods of inquiry may involve on the one hand highly elaborate and systematic statistical procedures and on the other the overwhelming field observations of a Norman Mailer in The Executioner's Song. To borrow Sternberg's question, which method provides depth and insight? Which reveals something of the uniqueness of human difference, human compassion and understanding? Such questions are not designed to suggest a preference for one method or hypothesis over another, merely that neither become an operant ideology. So when Eysenck or Jensen plead the genetic case on the grounds of "science" we ought to be careful about uncritical acceptance. When description and explanation become somewhat static or one-sided, especially in the context of human behavior, it is likely to become dogma. In addition, the question of whether the skill is environmentally or genetically controlled is an indication of how far critical

thinking theorists are from the more central issues; most still seem caught by a mind-body split. Nearly all of their theory, the subsequent creation of skill-based inventories and/or instructional programs still have to do with that organ responsible for the controversy, the human brain. In that regard, we might shift perspectives and ask a different question, namely, what are the environmental effects on the brain of behavior?

There are two general functions of the brain that should be of interest to those attempting to explain variations in critical thinking/mental performance: specificity and plasticity. Specificity involves those autonomic and invariant responses dealing with the programmed intake of sensory information. The complimentary--and for our purposes more intriguing--function is plasticity, which has to do with those learned responses to social experience. According to Stephen Rose, "...in the evolutionary path to man, there is an increase in plasticity, and a relative diminution in specificity."[26] In biological terms, what determines intelligence is the number of neural connections in the brain which allows for greater plasticity and Rose states that no post-mortem study can reveal the number of synaptic connections in the brain; in regard to structure, there was no apparent difference between the brain of Einstein and the average human being.[27] Hence, to speak exclusively or predominantly of the natural base of high I.Q. or mental performance is not only oversimplified but misleading. The problem of interpreting

mental performance remains with the highly varied plastic function--that development which reflects the continued interaction with the environment, "itself programmed into the genetic specification of the human."[28] What should be of importance is investigating the manner in which the plastic functions of the brain can be modified or altered environmentally.

There are obvious periods during the development of the fetus, when outside of severe physical trauma, the lack of proper nourishment can have devastating effects. If the number of the brain's possible neural connections are fixed, a lack of nourishment during the period of a person's fetal and infant development can have severe effects which last a lifetime. Low brain-weight ratios stay permanently outside standard limits and permanent deficiencies in brain DNA are never recovered. Such conditions are reflected in deficiencies in performance. Large families in the context of deprived social/economic backgrounds and maternal health are equally critical factors affecting low performance. When one adds the factor of high levels of air and water-borne toxins, from lead to the concentration of toxic waste-site dumps in the poorest areas of the nation, the reality of low performance on intelligence and/or critical thinking appears to be transgenerational.[29] In other words, a victimized female will most likely pass on lowered DNA levels to her offspring. Rose states:

In terms of human welfare and politics such effects are

> surely of great significance, because the obvious remedy lies at hand. Elaborate arguments as to the genetic effects on intelligence, which present a prescription for social and political inaction because they are at best remedial, can only hinder the eradication of this monstrous situation.[30]

III

The theoretical notion that the brain and the exercise of its potential is somehow immutable is a myth. In the same vein, those who argue that environmental influence is the only controlling element of the explanation of intellectual performance are equally narrow in their analysis. Neither hypothesis needs to be mutually exclusive. This is not to ignore the extent to which one's potential for development may be largely genetic. But potential offers no guarantee of achievement. The disposition to excel does not occur in a vacuum but is socially developed. It is through the experience of and with others that the self is organized and maintained and there is no characteristic of the person which exists in isolation. All human qualities are embedded in situations. What is clear is that the brain should not be viewed separate from its environment; it is a physical structure which interacts developmentally. Physical damage, malnutrition or exposure to high levels of carcinogens and toxins provide fairly accurate explanations of how health, behavior and performance can be detrimentally effected. And more important, those factors can be

remedied. In addition, detrimental effects need not necessarily be physical. Since D.O. Hebb's pioneering work, we now understand how the deprivation can be social as well.[31]

We must ask how harmful and maladaptive social environments contribute to the long-lasting changes in physiology and behavior. If the development and exercise of one's potential is largely social and the bond of social ties is language, then language may be used for a variety of purposes, from drawing out the best of one's capabilities to the terrorization of self. The abusive use of language in highly authoritarian social settings over time can generate as much damage to the community of self with others as lesions on the surface of the brain.[32] One may have the genetic potential for greatness but in punishing environments victims are chosen irrationally and their development and stability is painfully haunted.

Though "negative" social experiences may lead to deleterious effects in brain function, "positive" ones can enhance mental performance. The early work of David Kretch, et. al., found that greater sensory stimulation increased cortical activity and the production of acetylcholine.[33] Later experiments by Mark Rosenzweig and Edward Bennett discovered that "enriched environments" produced significant increases in the brain's weight and plastic functions.[34]

The point here is that there are some essential factors, some historical realities which are either being ignored or that simply overwhelm us. The research in critical thinking, though

well-intentioned and important, is in its infancy; it is currently too narrow and perhaps asking incomplete questions and avoiding others. In my view, it is also neglecting some indispensable research in other fields; the movement has yet to push itself beyond an academic battle for turf. When we design studies to evaluate everything from the skill to the spirit, we need to enlarge our perspective beyond the development of narrow programs and more fully consider those controversies regarding human nature and social reality which cut across academic disciplines and forms of knowing. Theorists, researchers and educators may have their own private agendas, and in attempting to understand the nature of critical thought, it may be not so much that our concepts and instruments are fragmented, but that we have a fragmented view of the very people we are attempting to assist and to whom we are directly attending.

Further, what are the values and priorities involved? What influences our instructional and research activities? Are we primarily serving those with economic or political power? It may be that the investigation into the nature of critical thought and its performance is somewhat misdirected; in assessing its components or attempting to explain high or low levels of performance we may be avoiding the far more serious question of how the policies of a particular economic and political order contribute to the results. If there are discrepancies in critical abilities between rich and poor, male and female, white and people of color, between those from advanced and deprived

nations, nations subjected to armed struggle and those who are not, then we need to know how those social and political conditions contribute to the variability. If deficiencies in nutrition or the results of deprived and/or traumatized environments do have the effects some researchers claim, then it is difficult to understand how we can design thinking programs which ignore these factors--or why food, housing and social conditions should not have priority over instructional programs designed to remedy conditions caused by such factors.

There is a form of extraordinary complacency and indifference by educators and leaders with what I am suggesting here. In one sense, it is understandable. To be aware and sensitive to the compounding levels of misery and injustice can be disorienting. As a mechanism of defense, we detach or abstract feelings which might otherwise interfere with the efforts to complete research or teach. But it is precisely what makes for the real danger. Paradoxically, an element of self-protection can subtly shift to acceptance, then acquiescence to a destructive social order. The syndrome is not new or unique to education. However, one cannot comprehend much of anything about the critical faculties of anyone without some attention being given to their social world. One investigation is inextricably linked to the other.

If valid and effective programs are to be developed at all levels of education, then a more effective interdisciplinary approach appears a necessity, including biologists and

neurologists. There have been incredible breakthroughs in our knowledge about the plastic functions of the brain as well as the manner in which socially and physically destructive environments can hamper mental performance across generations. Examining individual and group performance in the sometimes artificial educational setting can only lead to levels of error and distortion which prohibit the construction of sound theory and practice.

Notes

1.(NY: Harcourt, Brace & Jovanovich, 1978), 15.

2.See for example Liberal Education (Fall 1986), 221-262. Nearly the entire issue deals with the concerns by college and university administrators with the erosion of student abilities to think critically. Assuming a degree of consensus about what critical thinking is and means, there is the attempt to evaluate what programs could be instituted to alleviate the deficiencies. Though the purpose to which one's critical capacities should be put lingers over the discussion, it is an issue left largely unexplored. Such rationales as global competition or vocational proficiencies are the largest catalysts for curricular change, typically to the exclusion of questions over the quality of community in the context of economic and social justice. Yet, the complexity of the issues may run even deeper.

Though beyond the scope of this paper, the value of traditional reason itself has come under attack with the emergence of "postmodernist" theory. It is not certain what new understanding of thought postmodernism will bring to bear on education--whether the movement represents a new intellectual school or merely a new ideology justifying an aesthetic fashion or fad. However, postmodernism--admittedly difficult to define because it is such an experiential and unstable term--has had an affect across disciplines and its promise of a new critique of

reason or, more accurately, a rebellion against the traditional standards of reason, could lead to a somewhat vulgar form of irrationalism. See Jean-Frances Lyotard, The Postmodern Condition: A Report on Knowledge trans. Geoff Bennignton & Brian Massumi (Minneapolis: U of Minnesota P, 1984); Hal Foster, ed., The Anti-Aesthetic: Essays on Postmodern Culture (Port Townsend, WA: Bay Press, 1983); Richard Rorty, Consequences of Pragmatism (Minneapolis: U of Minnesota P, 1982). For an antidote, the defense of the western tradition by arguing for its redefinition rather than elimination, see Hannah Arendt, Between Past and Future (NY: Viking Press, 1961).

3.Harvey Siegel, Educating Reason: Rationality, Critical Thinking and Education (NY: Routledge, 1988), 39-45. The advertized need for a skill-based educational system, along with the support for applied, mission-oriented rather than basic research, has bent the integrity higher education since World War II. In his Godkin Lectures at Harvard in the early 1960s, Clark Kerr was one of the first to account for the redefinition of education from one of pursuing the ideal of free and open inquiry to the more practical realities of a service model for an advanced industrial state. He also suggested that we should not deceive ourselves about what had already happened, not to protest as did the infamous Lady of Kent who knew what it meant to seek the granting of favors or money. Sadly, he embraced rather than rejected the potential corruption of university life. Part of

the administrative rush toward the establishment of critical thinking programs might be best understood in light of his disturbing yet compelling prophecy.

4.To argue that critical thinking skills are field or context bound is one of the central issues afflicting the movement. If generalizable, then the assumption is that their acquisition in one field is transferable to others. As a form of wish-fulfillment, such a belief becomes necessary to the execution of various critical thinking programs in the educational setting. If not, it raise serious questions as to what precisely schools and universities are doing and achieving in employing those programs. See in particular John McPeck, Critical Thinking and Education (NY: St. Martin's P, 1981). McPeck argues that critical thinking always manifests itself with some subject and never in isolation and that the criteria of reasoning emerges from the uniqueness of the field under study. See also David Perkins and Gavriel Salomon, "Are Cognitive Skills Context-Bound," Educational Researcher (January-February 1989): 16-25; Joseph M. Walters and Howard Gardner, "The Development and Education of Intelligence," in Essays on the Intellect ed. Francis R. Link (Alexandria, VA: ASCD, 1985), 1-21. Along with McPeck, Gardner in particular has suggested that there are many forms of intelligence which require different kinds of skills which are as varied in their conceptualization and execution as music and athletics.

5.Robert H. Ennis, "A Concept of Critical Thinking," Harvard Educational Review 32, no. 1 (Winter 1962): 81-111.

6.Mark A. Schlesinger, 'The Road to Teaching Thinking: A Rest Stop," Journal of Education Vol. 36, no.3 (1984): 182-83.

7.Robert H. Ennis, "A Taxonomy of Critical Thinking Dispositions and Abilities," in Teaching Thinking Skills: Theory and Practice, eds. J.B. Baron and R.J. Sternberg (NY: Freeman, 1987).

8.See Edward D'Angelo, The Teaching of Critical Thinking (Amsterdam: B.R. Gruner, 1971). D'Angelo cites over thirty different definitions which often vary from field to field.

9.Much of the confusion and misdirection of the movement seems to be a function of assertions of the "best" method, which is typically associated with what a field of inquiry most frequently uses to establish claims, that issues may be resolved. And it is here that rhetorical scholars could make a difference. As part of the tradition of rhetoric, stasis theory could provide focus. An issue of fact is categorically different from an issue of value. One could employ the adopted methods of the sciences in resolving issues of social fact with a high level of certainty (or at least statistically so), assuming the correct procedures

are followed. Not even investigators in the physical sciences deal with questions of "truth." The truth is not a scientific question if we are to accept Karl Popper's view. Even Thomas Kuhn has suggested that the acceptance of scientific paradigms is not always value free. The principles of reasoning are of little difference, merely the method and procedures. Issues of value, i.e., the meaning of factual descriptions is another matter and has to do with arguments over criteria and criteria as a frame for evaluation can rarely if ever be objective. See Popper and Kuhn.

10. See Fed. R. Evid., in particular 104, 401, 403, 705 and 803.

11. For a more complete treatment of fields of argument, see Stephen Edelston Toulmin, The Uses of Argument (Cambridge, G.B.: Cambridge UP, 1958), 11-43. Toulmin suggests that one could explore the question of a universal logical form by examining standards by which claims are assessed which appear to field-dependent or invariant.

12. Harvey Siegel, "The Generalizability of Critical Thinking," ..

13. Ennis, 83.

14. See Robert H. Ennis, Jason Millman and Thomas N. Tomko, Cornell Critical Thinking Tests Level X & Level Z - Manual (Pacific Grove, CA: Midwest Publications, 1985).

15.Goodwin Watson and Edward M. Glaser, Critical Thinking Appraisal - Manual (NY: Psychological Corporation, 1980), 1; Barbara Z Presseisen, Thinking Skills: Research and Practice (Wash., D.C.: National Education Association, 1986), 25.

16.There is certainly criticism, if not confusion, primarily because as argued earlier there is no conceptual consensus about what critical thinking is. The CCTT and CTA are believed to be verbally loaded or measure only discrete, technical skills to the exclusion of the broader issues of values and their implications. In addition, they do not take into consideration knowledge or context--the importance of developing skills in content-specific domains as, for example, students might be required in graduate or professional school. The lack of agreement over critical thinking theory has led to a minor explosion of instructional methods, courses and programs, which are of varying quality. In reviewing studies of such programs, James McMillan found that the results failed to support the use of specific programs to enhance critical thinking skills. See James H. McMillan, "Enhancing College Students' Critical Thinking: A Review of Studies," Research in Higher Education Vol. 26, no. 1 (1987): 3-18; Robert Glaser, "Education and Thinking," American Psychologist Vol. 39, no. 2 (1984): 99-102.

17.Jerome S. Bruner, Jacqueline J. Goodnow and George A. Austin, A Study of Thinking (NY: John Wiley, 1956; Science Editions,

1962), 231-46.

18.Siegel, 39-47.

19.Ibid., 91. Richard Paul also views the ability in terms of a personal trait and suggests that the essential factor in critical thinking is the capacity to see ideas from the other's point of view and involves a tolerance for opposition. For Paul, teaching or reinforcing habits of reflection rather than skills or knowledge is what is central. See Richard Paul, "Dialogical Thinking: Critical Thought Essential to the Acquisition of Rational Knowledge and Passion," in Teaching Thinking Skills: Theory and Practice, ed. J.B. Baron and R.J. Sternberg (NY: Freeman, 1987). The experimental psychologist, Robert Sternberg, calls such a trait "novelty" or the ability to provide "insight" to problem-solving situations. Robert J. Sternberg, "Critical Thinking: Its Nature, Measurement and Improvement," in Essays on the Intellect, 53.

20.Ibid., 53-54. Several years ago Lloyd Crisp and I attempted to explain differences in critical thinking on the basis of the trait of dogmatism. After years of experimenting with different instructional methods in argument and problem-solving courses, we assumed that there were some factors other than the rational mediating the development of critical thinking skills. We attempted to explain variance across individuals and groups as a function of certain structural dimensions of personality. While

we also assumed that not all dimensions of personality are involved, some may be vitally important. We selected Milton Rokeach's dogmatism measure and the late David Freeman's self-cognition (self-distortion) inventory to discover the relationship, if any, between the two and an assessment of critical thinking (Watson-Glaser CTA). We hypothesized an inverse relationship between critical thinking and dogmatism--from high critical thinking/low dogmatism to low critical thinking/high dogmatism and found just such an association. We also had similar findings of association for Freeman's self-cognition inventory. One implication of the study was that teachers of critical thinking could be focusing on the wrong factors--skills as opposed to traits--factors largely ignored by researchers in the movement. See Lloyd Crisp and Ron Manuto, "Personality Characteristics, Gender and Critical Thinking," Journal of the Northwest Communication Association Vol. 18, no. 1 (Spring 1990), 1-25.

21.As McPeck has argued, mere technique is not unlike a rule-oriented game where if one learns the rules and how to impose them one wins. Though I have no grudge against rules in themselves, the question revolves around the extent to which they allow for flexibility and creativity; how they often impose limits on discovery. John E. McPeck, "Critical Thinking and the 'Trivial Pursuit' Theory of Knowledge," Teaching Philosophy Vol. 8 (1985): 295-308. It is both interesting and unfortunate that

communication scholars are infrequently present at national and international conferences on critical thinking. The potential contribution of those with a background in rhetorical theory and argument could provide many corrective suggestions to what is so often viewed as "newly discovered" by formal or informal logicians. For example, an analytical method of rhetorical invention, stasis theory, which dominated the rhetorical curriculum for nearly eighteen centuries, particularly in legal education, could be of significant instructional value in teaching students how to deal with controversy as well as develop lines of argument to resolve them; its exercise is rarely rule-bound nor are there tightly fixed ways to approach issues since rhetoric is less a science than an art built around the assumption of a probable, contingent world. See Paul A. Fritz and Richard L. Weaver, "Teaching Critical Thinking Skills in a Basic Speech Communication Course," Communication Education Vol 35, no. 2 (April 1986): 174-182. Though I seriously doubt stasis theory can be adequately integrated into a basic course, Fritz and Weaver are moving in a constructive direction.

22.Hans J. Eysenck, "The Place of Individual Differences in a Scientific Psychology," in Annals of Theoretical Psychology ed. K.B. Madsen and Leendert P. Most (NY: Plenum P, 1985), 237.

23.Ibid., 234-35. See also a comprehensive and critical examination of Eysenck's career in Sohan Modgil and Celia

Modgil's (ed.) Hans Eysenck: Consensus and Controversy (Phil., PA: The Falmer P, 1986). Eysenck's position is somewhat of a misrepresentation of the American social sciences. Our political history, as well as the early domination of behavioral learning theory, may have led to an "environmental" disposition by researchers, however, without the attribution of motives, there is little evidence that such factors altered research in the manner he claimed. For a charming and somewhat punishing critique of genetic theorists generally and Eysenck in particular, see Stephen Jay Gould, The Mismeasure of Man (NY: W.W. Norton, 1981), 146-233.

24.Hans S. Eysenck, The Structure and Measurement of Intelligence (Heidelberg: Springer-Verlag, 1979). Most geneticists agree that with any measure of mental capacity innate ability plays a role but rarely in absence of social experience; both must considered. See Walter F. Bodmer and Luigi Luca Cavalli-Sforza, "Intelligence and Race," Scientific American Vol. 223, no. 4 (October 1970): 19-29.

25.Eysenck, "The Place of Individual Differences," 276.

26.Stephen Rose, "Environmental Effects on Brain and Behavior," in Race and Intelligence ed. Ken Richardson and David Spears (Baltimore: Penguin Books, 1972), 131.

27.Ibid., 135.

28.Ibid.; Cf., Richard Held, "Plasticity in Sensory-Motor Systems," Scientific American Vol. 213, no. 5 (Nov. 1965): 85-93.

29.Ibid., 136; See also Urie Bronfenbrenner, "Ecological Systems Theory," in Annals of Child Development ed. Ross Vasta, Vol. 6 (Greenwich, CT: Jai P, 1989), 187-249. Bronfenbrenner has updated the statistics on brain-weight ratios and performance implications from recent U.S. Census Data. Holding maternal age and education constant, prenatal care was the most compelling factor in a reduction of the numbers of low birth weight.

30.Ibid., 139. See also Frank James Vingos and Ian Taylor, Clinical Psychology and Medicine: An Interdisciplinary Approach (Oxford: Oxford UP, 1981), 1824.

31.D.O. Hebb, The Organization of Behavior (NY: John Wiley, 1949), Chpts. 1, 6, 10 and 11. Some of the most dramatic effects of behavior on brain function can be found in captive states. For an account, see Lawrence E. Hinkle, Jr., "The Physiological State of the Interrogation Subject as It Affects Brain Function," in The Manipulation of Human Behavior ed. Albert D. Biderman and Herbert Zimmer (NY: John Wiley, 1961), 19-59.

32.See Martin Symonds, "Victim Response to Terror," Annals of the New York Academy of Sciences 347 (1980): 129-36; Leo Eitinger,

"Pathology of the Concentration Camp Syndrome," Archives of General Psychiatry 5 (1961): 371-79. Though the two social experiences discussed in the above articles represent extreme situations, they do illustrate how destructive and highly stressful environments produce findings of emotional disorders and, in some cases, meningoencephalopathy. A.D. de Groot performed some of the early work on the effect of the trauma of war on Dutch youth. During the early 1940s education in Holland had suffered serious setbacks and Dutch you who lived through the bombing and subsequent Nazi occupation show a significant drop in I.Q. scores. In addition, they exhibited shortened attention spans, generalized nervousness, absenteeism and apathy. A.D. de Groot, "The Effects of War Upon the Intelligence of Youth," Journal of Abnormal and Social Psychology Vol. 43, no. 3 (July 1948): 311-17. The literature on the traumatic effects of war on combat soldiers during the major conflicts in this century is extensive. However, it is not wholly unreasonable to view war as an analog for current conditions in some of our major urban areas; many of our young live in combat areas. A collapsing social and economic order can become so severe for some that many communities are now ruled by alienated and violent gangs with highly sophisticated military hardware. In the absence of caring or responsible institutions, crime and pathology are the norm rather than exception. For two insightful and sadly prophetic accounts of the origins of such tragedy, see Frantz Fanon, Black Skin, White Masks (NY: Grove Press, 1967); William A. Grier and

Price M. Cobb, Black Rage (NY: Basic Bks., 1968).

33.David Kretch, Mark Rosenzweig and Edward Bennett, "Environmental Impoverishment, Social Isolation and Changes in Brain Chemistry and Anatomy," Physiology and Behavior Vol. 1 (1966): 99-104; Edward Bennett, et. al., "Chemical and Anatomical Plasticity of Brain, Science Vol. 146 (1964): 610-19.

34.See Michael J. Renner and Mark R. Rosenzweig, Enriched and Impoverished Environments: Effects on Brain and Behavior (NY: Springer-Verlag, 1987). Renner and Rosenzweig argue that the most behaviorally meaningful changes resulting from differential experiences are found in the central nervous system, that the brain can be affected structurally and chemically. The authors review the research in the last 25 years and find strong evidence that enriched experiences were shown to be due to psychobiological processes common across species and further, that the application of this work in dealing with problems of mental performance, aging, brain trauma and malnutrition show promise.